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THE GENUS *JUSTICIA* (ACANTHACEAE) IN THE CHIHUAHUAN DESERT

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Justicia L. is the largest and most complex genus of Acanthaceae, containing 300 to 400 species. Although numerous segregate genera have been recognized, the current trend is to include *Dianthera* L., *Beleperone* Nees, *Jacobinia* Nees ex Moric., *Drejerella* Lindau, and others within the limits of *Justicia* (Gibson 1972, Durkee 1978). The genus is widely distributed in the tropics and subtropics of both hemispheres and occurs to a lesser extent in temperate areas. In the Chihuahuan Desert, *Justicia* may be distinguished from other Acanthaceae by the combination of two stamens with unequally inserted thecae of different sizes, the lower theca with a short spur, and the ampliate corolla tube. Although Standley (1926) does not list any species of *Justicia* from the Chihuahuan Desert Region of north-central Mexico, as defined by Henrickson and Straw 1976, four species, two of them described here, are now known to occur there. An additional species is known only from the arid regions of western Texas and the Chihuahuan Desert of southeastern New Mexico. These five rarely collected species comprise an unusual assemblage of linear-leaved, wispy subshrubs with ephemeral flowers. They can be distinguished by the following key:

1. Corolla 6.5–15 mm long; thecae more or less parallel to the filament, 0.5–1.3 mm long; spur on lower theca 0.2 mm long; seeds flat.
   2. Bractlets 10–19 mm long; calyx 5-lobed, 7–19 mm long, the lobes glandular; corolla 11–15 mm long, the outer surface glabrous. 1. *J. coahuilana*
   2. Bractlets 2.5–9 mm long; calyx 4-lobed, 2–4 mm long, the lobes eglandular; corolla 6.5–10.5 mm long, the outer surface pubescent.
      3. Young stems more or less evenly strigillose, the trichomes recurved-appressed: leaves pubescent.
         4. Leaves linear-subulate, 0.7–1.5 mm wide; corolla 6.5–7.5 mm long; lower theca 0.8–1 mm long. 2. *J. henricksonii*
         4. Leaves linear to oblanceolate, 1.5–4 mm wide; corolla 8.5–10.5 mm long; lower theca 1–1.3 mm long. 3. *J. wrightii*
      3. Young stems strigillose in two vertical, often decussate lines, the trichomes recurved; leaves glabrous. 4. *J. warnockii*
1. Corolla 15–20 mm long; thecae perpendicular or oblique to the filament, 1.9–2.8 mm long; spur on lower theca 0.5–1 mm long; seeds globose. 5. *J. linearis*

1. Justicia coahuilana T. F. Daniel, sp. nov. Figs. 1–2.

Planta suffruticosa, usque ad 3.5 dm alta. Caules juniores striati, glabri. Folia sessilia, linearia vel oblanceolata, 10–30 mm longa, 1–2 mm lata. Flores pedunculati, solitarii in axillis foliorum. Pedunculi 5–13 mm longi. Bracteolae 10–19 mm longae. Calyx quinquelobus 7–19 mm longus, extus glandulosus. Corolla glabra, 11–15 mm longa. Capsula 9–10 mm longa. Semina 3–3.5 mm diametro.

Erect to spreading, ± flimsy, suffrutescent perennial to 3.5 dm tall, arising from a woody base to 6 mm in diameter. Older stems whitish-grey or brown, ± striate, glabrous. Younger stems striate, the ridges brownish, the grooves greenish, glabrous. Leaves sessile, strongly ascendant, linear to narrowly oblanceolate, 10–30 mm long, 1–2 mm wide,

8–25 times longer than wide, acute at apex, the margins flat, glabrous. Flowers solitary in leaf axils, sessile between 2 bractlets at apex of a peduncle 5–13 mm long. Bractlets linear, 10–19 mm long, 0.5–0.8 mm wide, glabrous or with orangish, capitate glands along the upper 1/3, the glands 0.1–0.2 mm long. Calyx deeply 5-lobed, 7–19 mm long, glabrous below, glandular like the bractlets on the upper 1/2; tube 0.3–0.8 mm long; lobes linear-subulate, 6.5–18.5 mm long. Corolla bilabiate, 11–15 mm long, glabrous on outer surface; tube 5–7 mm long; lips 7–8 mm long. Stamens 4 mm long; filaments 3.5 mm long, glabrous; thecae ± parallel to filament, the upper theca 0.8 mm long, the lower theca 1 mm long including a spur 0.2 mm long. Style 7–8 mm long, glabrous; stigma ± capitate to minutely bilobed, the lobes 0.2 mm long. Capsules stipitate, 9–10 mm long, glabrous; stipe 3–3.5 mm long; head elliptical, laterally compressed, 6–7 mm long including a terminal beak to 1 mm long, 3–4 mm wide; retinacula 1.5 mm long. Seeds 4 (or fewer by abortion) per capsule, round, flat, obliquely notched at chalazal end, 3–3.5 mm in diameter; testa smooth and glabrous on one side, smooth to muriculate and pubescent on the other, the trichomes appressed to erect, 0.1 mm long; margin recurved, fringed with minute capitate glandular trichomes 0.1 mm long.

Type: MEXICO. Coahuila: Mouth of canyon, 4 miles W of Cuatro Ciénegas, 24–26 Aug 1938 flr & frt, *Johnston 7162* (GH, holotype).

Paratype: MEXICO. Coahuila: Rocky slopes of canyon, 4 miles W of Cuatro Ciénegas, 2800 ft, 26 Aug 1938, *Shreve 8465* (ARIZ).

This species is known only from a canyon west of Cuatro Ciénegas in central Coahuila. According to D. J. Pinkava (pers. comm.), the Cuatro Ciénegas Basin and the surrounding mountains are extremely rich in species, the area being one of the richest in the Chihuahuan Desert Region.

2. Justicia henricksonii T. F. Daniel, sp. nov. Figs. 1–2.

Planta suffruticosa, usque ad 3 dm alta. Caules juniores striati, pubescentes. Folia sessilia, linearia-subulata, 7–20 mm longa, 0.7–1.5 mm lata. Flores solitarii, sessiles in axillis foliorum vel brevipedunculati apicibus ramorum. Bracteolae 4–9 mm longae. Calyx quadrilobus 3–3.5 mm longus, extus eglandulosus. Corolla strigillosa, 6.5–7.5 mm longa. Capsula 7–7.5 mm longa. Semina 2.5–3 mm longa, 2.5 mm lata.

Erect, basally branched, wispy, suffrutescent perennial to 3 dm tall, arising from a stout or gnarled woody caudex to 15 mm in diameter. Older stems whitish-grey, striate to terete, glabrate. Younger stems green, striate, ± evenly and sparsely strigillose, the trichomes eglandular, recurved-appressed, 0.1–0.2 mm long. Leaves sessile, horizontal to ascendant, linear-subulate, 7–20 mm long, 0.7–1.5 mm wide, 10–27 times longer than wide, acute at the apex, the margins flat, pubescent like the young stems although frequently more densely so. Flowers solitary, sessile in leaf axils or short-pedunculate at branch apices, subtended by 2 bractlets. Peduncles 1–2 mm long. Bractlets linear-subulate, (2.5–) 4–9 mm long, 0.5–0.9 mm wide, pubescent like the leaves or more densely so. Calyx deeply 4-lobed, 3–3.5 mm long, pubescent like the bractlets; tube 0.5–1 mm long; lobes subulate, 2–3 mm long. Corolla pinkish, bilabiate, 6.5–7.5 mm long, strigillose on outer surface, the trichomes 0.2–0.3 mm long; tube 3.5–4 mm long; upper lip emarginate, 2.5–3 mm long, lower lip trilobate, 2.5–3 mm long, the lobes 1.5–2 mm long, 1.5–2 mm wide, the central lobe larger than the outer lobes. Stamens 3 mm long; filaments 2.5 mm long, glabrous; thecae ± parallel to filament, the upper theca 0.5–0.7 mm long, the lower theca 0.8–1 mm long, including a spur 0.2 mm long. Style 2.5–4 mm long, strigillose at base; stigma ± capitate to minutely bilobed, the lobes 0.2 mm long. Capsules stipitate, 7–7.5 mm long, glabrous to sparsely strigillose below, strigillose on beak, the trichomes 0.2–0.3 mm long; stipe 2–2.5 mm long; head elliptical,

FIG. 1. *Justicia coahuilana* and *J. henricksonii*, a–d, *J. coahuilana* (from holotype): a) habit, X 0.5; b) leaf, X 3; c) opened capsule with one seed and persistent calyx, X 4; d) sepal tip, X 5. e–i, *J. henricksonii* (from holotype): e) habit, X 0.5; f) leaf, X 3.5; g) capsule and persistent calyx, X 3.5; h) sepal tip, X 11.5; i) opened capsule with three seeds, X 3.

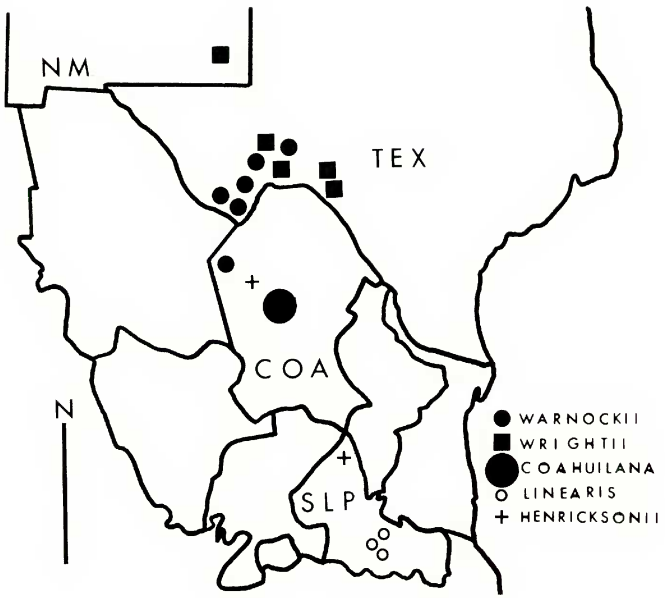

FIG. 2. Distribution of the species of *Justicia* in the Chihuahuan Desert and adjacent areas.

laterally compressed, 4.5–5 mm long including a terminal beak 0.5–0.8 mm long, 4 mm wide; retinacula 1.3–1.5 mm long. Seeds 4 (or fewer by abortion) per capsule, round to obcordiform, flat, obliquely notched at chalazal end, 2.5–3 mm long, 2.5 mm wide; testa muriculate, floccose; margin flat to somewhat recurved, fringed with glandular trichomes 0.2–0.3 mm long.

Type: MEXICO. Coahuila: Road from Puerto del Caballo easterly, 16 km across the broad valley to the low hills at Tanque Jerico, ca. Lat. 27° 34′ N, valley floor, one colony on silty barreal, 22–23 Aug 1941 flr & frt, *Johnston 8324* (GH, holotype; F, GH, isotypes).

Paratype: MEXICO. San Luis Potosí: 24 miles S of Salado, in shade of bushes, 5550 ft, 22 Aug 1940, *Shreve & Tinkham 9631* (GH).

Justicia henricksonii appears to be most closely related to *J. wrightii* of the United States, from which it differs by its more robust habit, less densely strigillose stems, narrower leaves, smaller corollas, and shorter thecae. Shreve and Tinkham's fruiting specimen from San Luis Potosí is a flimsier, more open plant with somewhat longer leaves and

internodes than the type material from Coahuila. However, in these characters there is considerable overlap with Johnston's specimens and in all other characters this plant is indistinguishable from *J. henricksonii.* The label data on Shreve and Tinkham's specimen note that the plant grew "in shade of bushes," and this specimen is therefore regarded as a shade form of *J. henricksonii.*

This species is named in honor of Dr. James Henrickson, a student of the Acanthaceae of the Chihuahuan Desert Region who has given me considerable assistance during my study of the Acanthaceae of Mexico.

3. Justicia wrightii A. Gray, Syn. Fl. N. Am. 2: 329. 1878.

Ecbolium wrightii (A. Gray) O. Ktze., Rev. Gen. 2: 981. 1891. Type: Texas: Val Verde Co.: Western Texas to El Paso, New Mexico, calcareous hills on the San Felipe, May–Oct 1849, *Wright 445* (GH, holotype; US, isotype).

Erect, basally branched, suffrutescent perennial, 8–15 cm tall, arising from a stout, woody caudex to 7 mm in diameter. Older stems whitish-grey or brown, striate, glabrate. Younger stems striate, the ridges frequently brownish, the grooves green, ± evenly strigillose, the trichomes eglandular, recurved-appressed, 0.1–0.2 mm long. Leaves sessile, ascendant, linear to oblanceolate, (5–) 10–15 mm long, 1.5–4 mm wide, 2.8–8.6 times longer than wide, usually reduced in size acropetally, acute to rounded at apex, the margins flat, pubescent like the young stems. Flowers solitary, sessile in leaf axils, subtended by 2 bractlets. Bractlets linear-subulate, 2.5–6 cm long, 0.5–0.7 mm wide, pubescent like the leaves. Calyx deeply 4-lobed, 2.5–3.8 mm long, pubescent like the leaves; tube 0.4–0.5 mm long; lobes subulate, 2–3.3 mm long. Corolla purplish, bilabiate, 8.5–10.5 mm long; tube 4.5–5 mm long; upper lip emarginate, 4.5–6 mm long, 2.8–3 mm wide at base; lower lip trilobate, 4–5.5 mm long, the lobes 3–4 mm long, 1.5–3.5 mm wide, the central lobe larger than the outer lobes. Stamens 3–5 mm long; filaments 2–3.5 mm long, glabrous; thecae ± parallel to filament, the upper theca 0.6–0.9 mm long, sparsely strigillose, the lower theca 1–1.3 mm long including a spur 0.2 mm long. Style 4.5–6 mm long, sparsely strigillose near base; stigma ± capitate, 0.2–0.3 mm long. Capsules stipitate, 8 mm long, glabrous or with a few scattered trichomes at apex; stipe 2 mm long; head elliptical, laterally compressed, 6 mm long including a terminal beak 0.8–1 mm long, 3.7–4 mm wide. Seeds not seen, reported as oval to elliptic, 2.5 mm long, 3 mm wide, mucronate, puberulent (Wasshausen 1966).

Additional specimen examined: U.S.A. New Mexico: Eddy Co.: Carlsbad, 9 Jun 1958, *McKechnie 29* (MO).

Justicia wrightii is reported to be endemic to the western edge of the Edwards Plateau in Texas (Correll and Johnston 1970), and this report extends its range into the Chihuahuan Desert of southeastern New Mexico (Fig. 2). The only other *Justicia* known from this part of the Chihuahuan Desert is *J. warnockii,* which may be expected to occur in New Mexico as well. Both species are sufficiently rare to be listed as threatened species in Texas (Ayensu and DeFilipps 1978).

4. Justicia warnockii Turner, Field & Lab. 19: 100. 1951. Type: Texas: Brewster Co.: Limestone slope one third way up Old Blue, Glass Mountains, 2 Jun 1941, *Warnock W325* (TEX, holotype; DS, F, GH, NCU, NY, PH, SRSC, UC, UCLA, isotypes).

Erect, basally branched, broom-like to globose suffrutescent perennial to 40 cm tall, arising from a stout, woody caudex, 5–15 (–25) mm in diameter. Older stems whitish-grey, striate to terete, glabrate. Younger stems green, striate, strigillose (rarely only slightly so) in 2 vertical, often decussate lines, the trichomes eglandular, recurved,

0.05–0.2 mm long. Leaves sessile, strongly ascendant, linear to narrowly oblanceolate (to obspatulate near base of plant), 2.5–20 mm long, 0.4–1.3 (–2) mm wide, 6–18 times longer than wide, acute at apex, the margins flat to somewhat revolute, glabrous. Flowers solitary, sessile in leaf axils or sessile in the axils of reduced leaves or bracts along the upper portion of the stem, forming a spicate axis to 8 cm long, each flower subtended by 2 bractlets. Bractlets linear-subulate to filiform, 2.5–4.5 mm long, 0.2–0.4 mm wide, glabrous. Calyx deeply 4-lobed, (2–) 3–4 mm long, strigillose, especially near base; tube 0.3–0.5 mm long; lobes subulate, (1.5–) 2.5–3.5 mm long. Corolla lavender with purplish markings in throat, bilabiate, 7–10 mm long, strigillose on outer surface; tube 4.5–5 mm long; upper lip emarginate, 4–5 mm long, 1.3–2.2 mm wide at base, lower lip 6 mm long, trilobate, the lobes 2–3 mm long, 1.2–3 mm wide, the central lobe larger than the outer lobes. Stamens 3.5 mm long; filaments 2–3 mm long, glabrous; thecae ± parallel to filament, the upper theca 0.5–0.6 mm long, the lower theca 0.7–0.8 mm long including a spur 0.2 mm long. Style 5–7 mm long, glabrous; stigma ± capitate, 0.2 mm long. Capsules stipitate, 6.5–8 mm long, glabrous; stipe 2–3.2 mm long; head elliptical, laterally compressed, 4.5–5 mm long including a terminal beak 0.5–0.8 mm long, 2.5–3 mm wide; retinacula 1–1.8 mm long. Seeds 4 (or fewer by abortion) per capsule, round to oval, flat, obliquely notched at chalazal end, 2–2.5 mm long, 2–2.5 mm wide; testa granulate, glabrous (or glandular); margin flat to recurved, fringed with capitate glandular trichomes 0.1 mm long.

Additional specimens examined: U.S.A. Texas: Brewster Co.: Reagan Canyon, 1800 ft, 24 Dec 1946, *Warnock & Hinckley 3742* (NY); limestone slopes of Reagan Canyon, 3 miles from the Rio Grande, 24 Dec. 1946, *Hinckley & Warnock 461097* (TEX, UC); Crockett Co.: Rocky limestone bluff of Pecos River, above its junction with Independence Creek, 6 Jul 1949, *Webster 492* (MICH); Pecos Co.: Rocky limestone slopes, main canyon on NE side of Sierra Madera, about 25 miles S of Fort Stockton, 26 May 1949, *McVaugh 10654* (DS, DUKE, ENCB, MICH, MO, NY, PH, UC); mesa margins, 17 Jul 1943, *Tharp 43-854* (NY, PH, UC). MEXICO. Coahuila: Calcareous eastern foothills of the Sierra de las Cruces, Picacho de San José, rocky N ridge, 17 Aug 1941, *Johnston 8205* (F, GH); about 15 miles below Picacho del Centinela in limestone soil, 24 Aug 1953, *Warnock 11536* (MICH).

This species is reported to be endemic to the Trans-Pecos region of western Texas (Correll and Johnston 1970). This report extends its known range into the Chihuahuan Desert of western Coahuila (Fig. 2). Turner (1951) noted the unique vegetative aspect of *J. warnockii* and its similarity to *Carlowrightia linearifolia* A. Gray. Indeed most collections are annotated as the latter species. Fertile material of *J. warnockii* may be distinguished from *C. linearifolia* by the obliquely attached thecae, the lower theca with a spur, and by the retinacula which are inserted at different heights in each locule of the capsule. Vegetatively, *C. linearifolia* is a tall (to 1 m), openly-branched shrub with evenly puberulent stems and leaves. In contrast, *J. warnockii* is a low (to 4 dm), broom-like subshrub with strigillose stems, the trichomes being disposed in two vertical lines, and glabrous leaves.

5. Justicia linearis Rob. & Greenm., Amer. J. Sci. 50: 161. 1895. Type: Mexico. San Luis Potosí: Dry hills, Las Tablas, 5 Aug 1891, *Pringle 5038* (GH).

Erect to decumbent subshrub to shrub to 4 dm tall. Older stems whitish-grey, irregularly fissured, glabrate below, canescent above. Younger stems green, striate, strigillose-canescent, the trichomes evenly distributed, straight to recurved, 0.3–0.5 mm long. Leaves sessile, mostly crowded at nodes of new growth, strongly ascendant, linear to filiform, 7–40 mm long, 0.5–2 mm wide, 10–30 times longer than wide, acute at apex, the margins revolute, pubescent like the young stems although the trichomes are frequently shorter, the older leaves whitish-grey, persistent. Flowers solitary, sessile in leaf axils, subtended by 2 bractlets. Bractlets linear-subulate, 6–9 mm long, 0.7–1 mm wide, pubescent like the leaves, the margins conspicuously ciliate. Calyx deeply 5-lobed, 8–11

mm long, pubescent like the bractlets; tube 1–2 mm long; lobes subequal, linear-subulate, 6–10 mm long. Corolla white on outside, lobes maroon-purple within, bilabiate, 15–20 mm long, strigillose on outer surface; tube 10–11 mm long, upper lip entire to emarginate, 5.5–6.5 mm long, 4.5–5 mm wide at base, with a prominent rugula within; lower lip 5–9 mm long, trilobate, the lobes 3–5 mm long, 2–4 mm wide, the central lobe larger than the outer lobes. Stamens 8–8.5 mm long; filaments 6.5–7 mm long, glabrous; thecae perpendicular or oblique to filament, the upper theca 1.9–2.1 mm long including a basal spur 0.05–0.3 mm long, the lower theca 2–2.8 mm long including a basal spur 0.5–1 mm long. Style 12 mm long, glabrous above, pubescent along lower half, the trichomes ascending, 0.2–0.4 mm long; stigma capitate to bilobed, the lobes 0.2–0.3 mm long. Capsules stipitate, 11–15 mm long, pubescent, the trichomes 0.3–0.4 mm long; stipe 4–8 mm long; head elliptical, not laterally compressed, 7–8 mm long including a terminal beak 0.5–0.8 mm long, 4.5–5 mm wide; retinacula 2 mm long. Seeds 4 (or fewer by abortion) per capsule, globose, 3 mm in diameter, testa smooth, with an understory of appressed trichomes 0.05 mm long, and an overstory of scattered, flexuous trichomes 0.2–0.3 mm long.

Additional specimens examined: MEXICO. San Luis Potosí: San Francisco, 20 km al NE de Rioverde, 1000 m, llano con vegetación de mezquital, 14 Sep 1954, *Rzedowski 5141* (MO); ± 5 km al SE de San Francisco, Mpio. de Rioverde, ± 1000 m, terrenos aluviales con vegetación de mezquital, 21 Jan 1957, *Rzedowski 8653* (MICH); open plains near San Francisco, 800–1200 m, 14–15 Sep 1954, *Sohns 1259* (US); Las Tablas, rocky hill, 1000–1100 m, 9–10 Aug 1934, *Pennell 18033* (GH, US); 47.5 road miles E of El Huizache (at Hwy. 57) on Hwy. 80 to Cd. del Maiz, 23.1 miles W of Cd. del Maiz, in gypsum flats, 1200 m, 24 Sep 1978, *Henrickson & Lee 17574* (MICH).

This species is found in the southernmost part of the Chihuahuan Desert in central San Luis Potosí and in the semi-arid associations in the vicinity of San Francisco in the southeastern part of the state (Fig. 2). The four preceding species appear to form a closely related group from which *J. linearis* differs in several important characters. In addition to its larger corolla, thecae, and thecal spurs, the thecae of *J. linearis* are more perpendicular than parallel to the filament, and the seeds are globose rather than flat.

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